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SELECTION INDICES FOR SEED YIELD IN MUNGBEAN

M. Siddique Sadiq and G. Abbas

Nuclear Institute for Agriculture and Biology, Faisalabad, Pakistan.

ABSTRACT

Genetic parameters, correlation and path analysis were computed for days to flower and mature, plant height, seed yield, and yield related traits in mungbean germplasm originating from hybridization of exotic AVRDC accessions and NIAB MUNG 92. Highly significant differences were observed in all the characters. High heritability values (81-89%) were observed for days to flower, days to mature, plant height and 100 seed weight. Harvest index had 62.6 % heritability along with maximum value of genetic advance (41.13%). Harvest index showed positive and significant association with seed yield. Days to flower and plant height showed positive and significant relationship with biological yield. The magnitude of direct effect of harvest index was maximum and 100 seed weight had the highest indirect effect via harvest index. The results suggest that harvest index and 100 seed weight should be given the maximum consideration for yield improvement and that an appropriate selection indices should be formulated, so that advance in one yield component is not nullified by the deterioration in the others.

Key words: Genetic advance, path analysis, heritability, selection indices.

INTRODUCTION

In Pakistan, mungbean (*Vigna radiata* (L.) Wilczek) is the major summer pulse crop grown on an area of approx. 225 thousand ha with an annual production of 130 thousand tons having a seed yield of 577 Kg ha^{-1} (Anonymous 2004 -05). The pulse yield is much below the optimum level especially in comparison with cereals and demands a greater need for improvement either through the utilization of available genetic diversity or created by induced mutation techniques. The availability of useful variability in germplasm is essential for systematic breeding. An evaluation and characterization of already existing germplasm for important morphological and economic traits is necessary to identify genotype suitable for direct utilization or through combination breeding.

The present investigation was designed (i) to characterize/evaluate elite lines by assessing their variability in terms of heritability and genetic advance for morphological and economic traits and (ii) to determine their association to develop reliable selection criteria under field conditions.

MATERIALS AMD METHODS

Twenty elite lines originating from hybridization of exotic AVRDC germplasm (VC 1973, VC 1560D, VC 2768A, VC 2768B, VC 3902) and NIAB MUNG 92 developed at NIAB, Faisalabad, were planted in randomized complete design, with three replications at Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad, Pakistan during summer 2005. Each genotype consisted of four rows, 4 m. long, spaced 30 cm. apart with 10 cm. plant-to-plant distance. Inorganic fertilizers N (58 Kg ha^{-1}) and P_2O_5 (22 Kg ha^{-1}) were applied at the sowing time. Stomp 330-E (N-Ethylpropyl)-3, 4- Dimethyle-2, 6-Dinitro benzenamine) was applied as a pre-emergence weedicide (3.75 litre ha^{-1}). After making necessary thinning, single seedling per hill was maintained.

Data on days taken to 50% flowering and 90% pod maturity, plant height, hundred seed weight, biological yield, seed yield, and harvest index were recorded. An area of 4.8 m^2 was harvested, sun dried, and biomass yield was recorded. Seed yield was taken after manual threshing. Harvest index was calculated as the ratio of seed yield to biomass yield. The data were subjected to analysis of variance (Steel and Torrie, 1984), and genetic parameters were estimated (Singh and Chaudhary, 1979). To determine the relationship among the characters, correlation coefficient and path analysis were computed (Dewey and Lu, 1959).

RESULTS AND DISCUSSION

Highly significant differences were observed for all the morphological and economic traits (Table 1). It demonstrated that the population was amenable for selection for all the traits (Khattak *et al.,* 1995). The phenotypic coefficients of variations for all the traits were higher as compared to genotypic coefficients of variations (Table 1) ascribing the presence of environmental influence on the expression of these traits.

High phenotypic coefficients of variation were recorded for harvest index, seed yield, and biological yield. The same traits also exhibited higher genotypic coefficient of variability. The highest phenotypic and genotypic coefficient of variabilities: 37.52% and 29.68% respectively, existed for harvest index and the lowest, 2.48% and 2.26%, respectively for days to mature. High heritability values were observed for 100-seed weight (89.7%), days to flower (87.8%), days to mature (82.8%) and plant height (81.5%). Moderate heritability values were observed for biological yield (53.6%), seed yield (51.9%) and harvest index (62.6%) revealing considerable variability available for improvement. The highest genetic advance (41.13%) was observed for harvest index. The heritability and genetic advance did not follow similar pattern and the characters having high heritability necessarily did not show high-expected genetic advance. Hundred seed weight also had the highest heritability value with expected genetic advance of 28.70 percent. High genetic advance combined with reasonably high heritability value as in harvest index, 100 seed weight, plant height, and seed yield indicated that these attributes were mainly controlled by additive type of genes. Progress in improving these traits can be achieved through mass selection (Johnson *et al* 1955) whereas characters viz. days to flower and mature had high heritability estimates, may not be considered for mass selection. These characters appeared to be governed by nonadditive type of genes; dominant genes, epistasis or their interaction.

Table 1. Mean and Genetic parameters for various morphological and economic traits in mungbean

Character	Mean	Mean Square	Phenotypic Coefficient of Variation (%)	Genotypic coefficient Variation (%)	Heritability (%) (% of mean)	Genetic Advance
Days to flower	39.50	29.364**	8.26	7.74	87.8	15.88
Days to mature	68.50	7.684**	2.48	2.26	82.8	4.37
Plant height (cm)	102.00	942.053**	18.55	16.74	81.5	38.89
100-seed weight (g)	4.90	1.842**	16.57	15.67	89.7	28.70
Biological yield (g)	3233.00	1140797.000**	35.03	25.64	53.6	32.68
Seed yield (g)	361.50	33224.790**	23.13	16.67	51.9	27.53
Harvest index (%)	13.09	54.329**	37.52	29.68	62.6	41.13

Table 2. Genotypic correlation coefficients of different morphological and economic traits of mungbean.

Character	Days to Mature	Plant Height	100-seed weight	Biological Yield	Harvest Index	Seed Yield
Days to Flower	0.6366**	0.8025**	-0.1425	0.6878**	-0.6347**	-0.2082
Days to mature		0.7963**	-0.5799**	0.3648	-0.5571*	-0.4473*
Plant height			-0.3715	0.5476*	-0.7296**	-0.4789*
100-seed weight				-0.0074	0.3369	0.4585*
Biological yield					-0.5678**	0.1572
Harvest index						0.6883**

Table 3. Path coefficient analysis of different morphological and economic traits in mungbean.

Character	Days to Flower	Days to Mature	Plant Height	100-seed Weight	Biological Yield	Harvest Index	Genotypic Correlation
Days to flower	<u>-0.012</u>	0.032	-0.4616	0.0012	1.0261	-0.8542	-0.2082
Days to mature	-0.009	<u>0.455</u>	-0.4844	0.0053	0.685	-0.8018	-0.4473*
Plant height	-0.810	0.043	<u>-0.5126</u>	0.0036	0.8895	-1.0099	-0.4789*
100-seed weight	0.002	-0.0287	0.2200	<u>-0.0084</u>	-0.0324	0.5240	0.4585*
Biological yield	-0.011	0.0289	-0.4230	0.0003	<u>1.0781</u>	-0.8220	0.1572
Harvest index	0.009	-0.0323	0.4587	-0.0039	-0.7853	<u>1.1285</u>	0.6883**

The estimates of correlation coefficient between seed yield and its components are presented in Table-2. Days to flower showed positive and highly significant association with days to mature, plant height and biological yield and also had highly significant but negative relationship with harvest index. The average weight of 100 seeds had positive and significant correlation with seed yield. Abbas *et al.* (2005) observed similar correlations between seed yield and 100 seed weight. Significant correlation was also noted between 100 seed weight and seed yield. (Khattak *et al.* (1995) also observed positive correlation between these two traits. Harvest index showed positive and significant correlation with seed yield. Biological yield showed non-significant correlation with seed yield.

Direct positive effects were observed in harvest index, biological yield and days to mature (Table 3). Among the characters having high positive direct effects, harvest index showed positive and significant correlation with seed yield. Biological yield showed positive but poor correlation with seed yield. All other attributes showed negative direct effects and negative correlation with seed yield. Harvest index showing true relationship with seed yield may be taken directly as a base for high yielding genotypes. The highest indirect effects of days to flower and mature, and plant height were observed via biological yield. One hundred seed weight also showed positive indirect effect via harvest index. These attributes can be exploited indirectly for selection (Singh and Chaudhary, 1979).

It may be inferred that selection for genotypes having high yield potential may be based on harvest index and 100 seed weight. Both these characters are easily measurable and do not require sophisticated equipments.

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